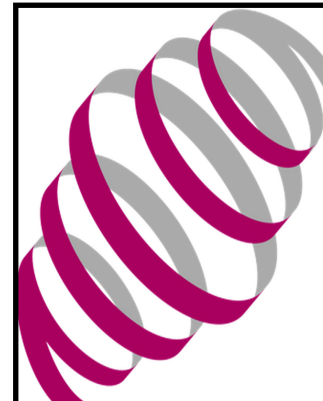


LSM Status update from the LOFAR polarisation busy week

David Mulcahy
University of Manchester

MANCHESTER
1824

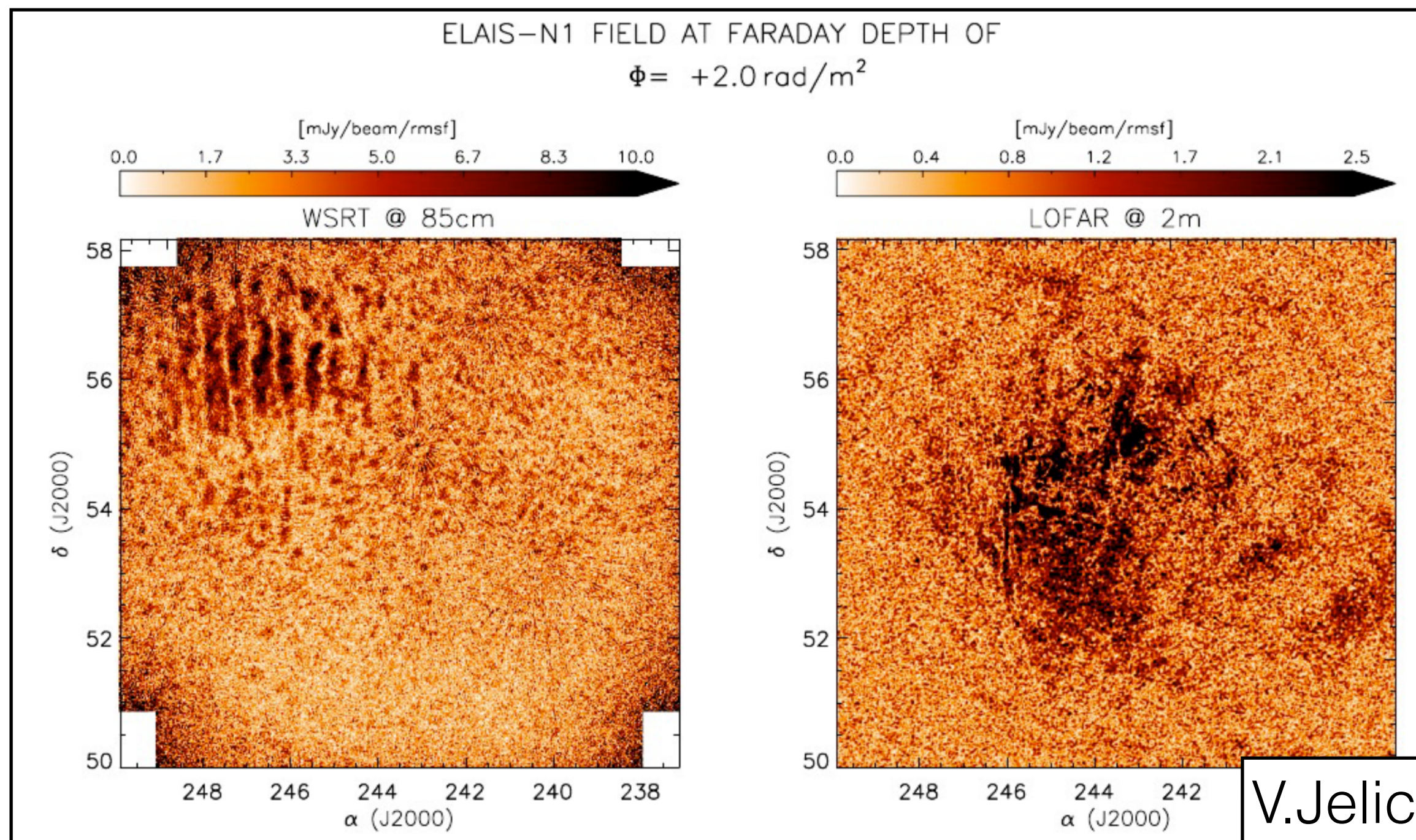
The University of Manchester



LOFAR

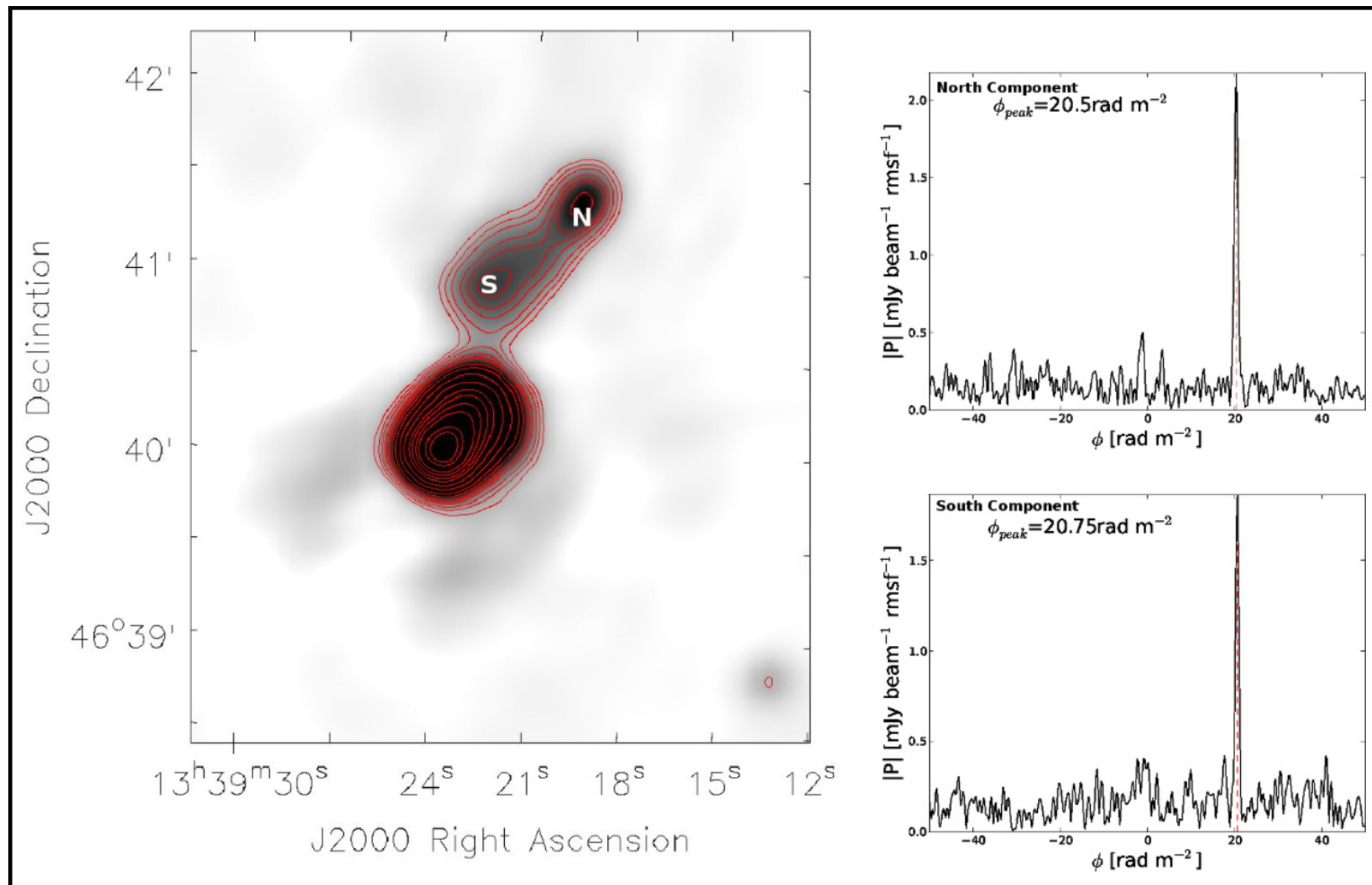
Observing Polarization with LOFAR

Polarized Foreground Observations observed in many observations already such Iacobelli (2014) and Jelic (2014)



Observing Polarization with LOFAR

Polarization has been observed for extragalactic sources,
6 polarized sources found in a single field.



Mulcahy et al. 2014

LOFAR Polarization Busy Weeks

There is a need to properly calibrate and understand
LOFAR polarization data.

Restarting polarization busy weeks

- polarization calibration workshop
take place in Manchester (next in August)
- polarization analysis workshop
take place in ASTRON (next in June)

Occurs alternatively every 2 months

1st Polarization calibration busy week

Took place from the 22-24th April at the University of Manchester.

10 participants with several more online for discussions

Alex Clarke (University of Manchester)

Henrik Junklewitz (University of Bonn)

Valentina Vacca (MPA)

Volker Heeren (University of Southampton)

Cameron Van Eck (University of Nijmegen)

Manu Orru (ASTRON)

Marco Iacobelli (ASTRON)

Therese Cantwell (University of Manchester)

Anna Scaife (University of Manchester)

David Mulcahy (University of Manchester)



Correction for Faraday Rotation caused by the ionosphere

- Ionized plasma and Earth's Magnetic Field apply a rotation to polarized signal.
- Typical RM values is 1-3 rad/m²
- RM can vary due to TEC (Total electron content) variation
- Variation in field of view

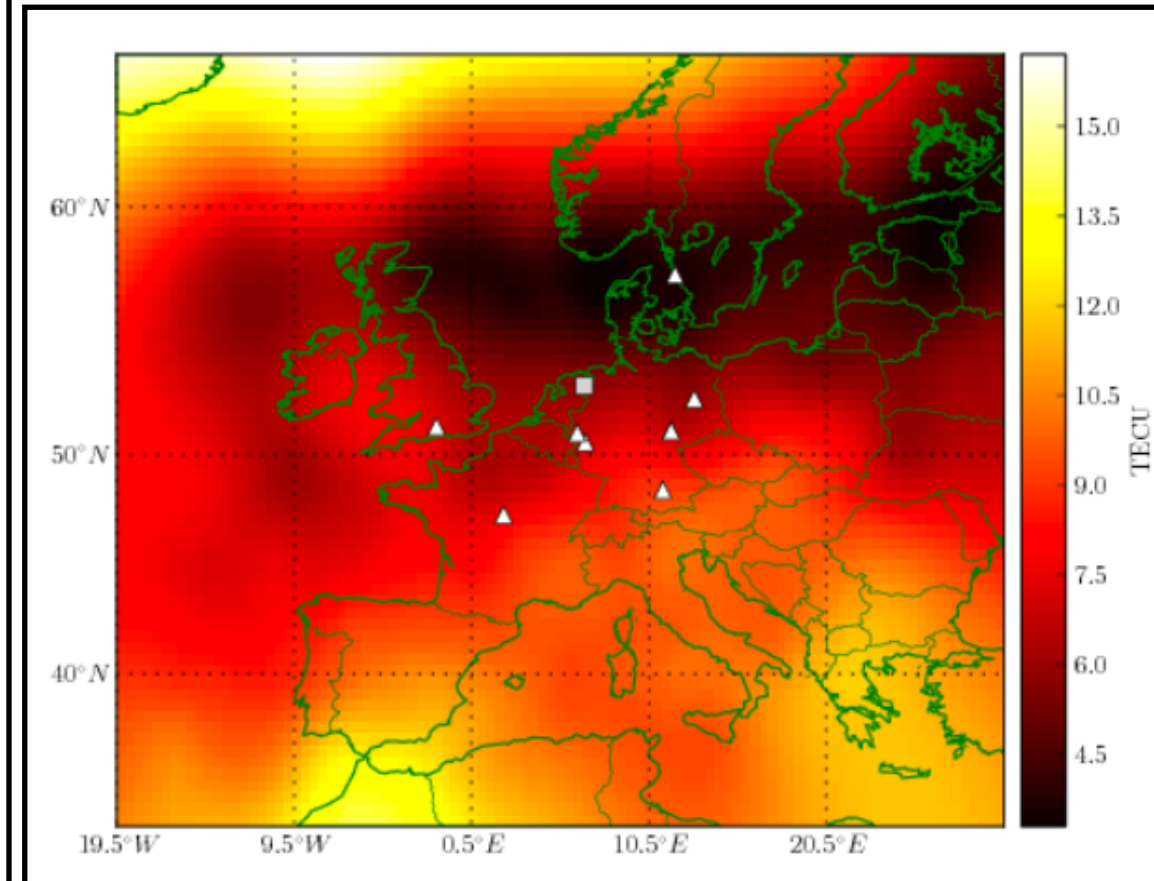
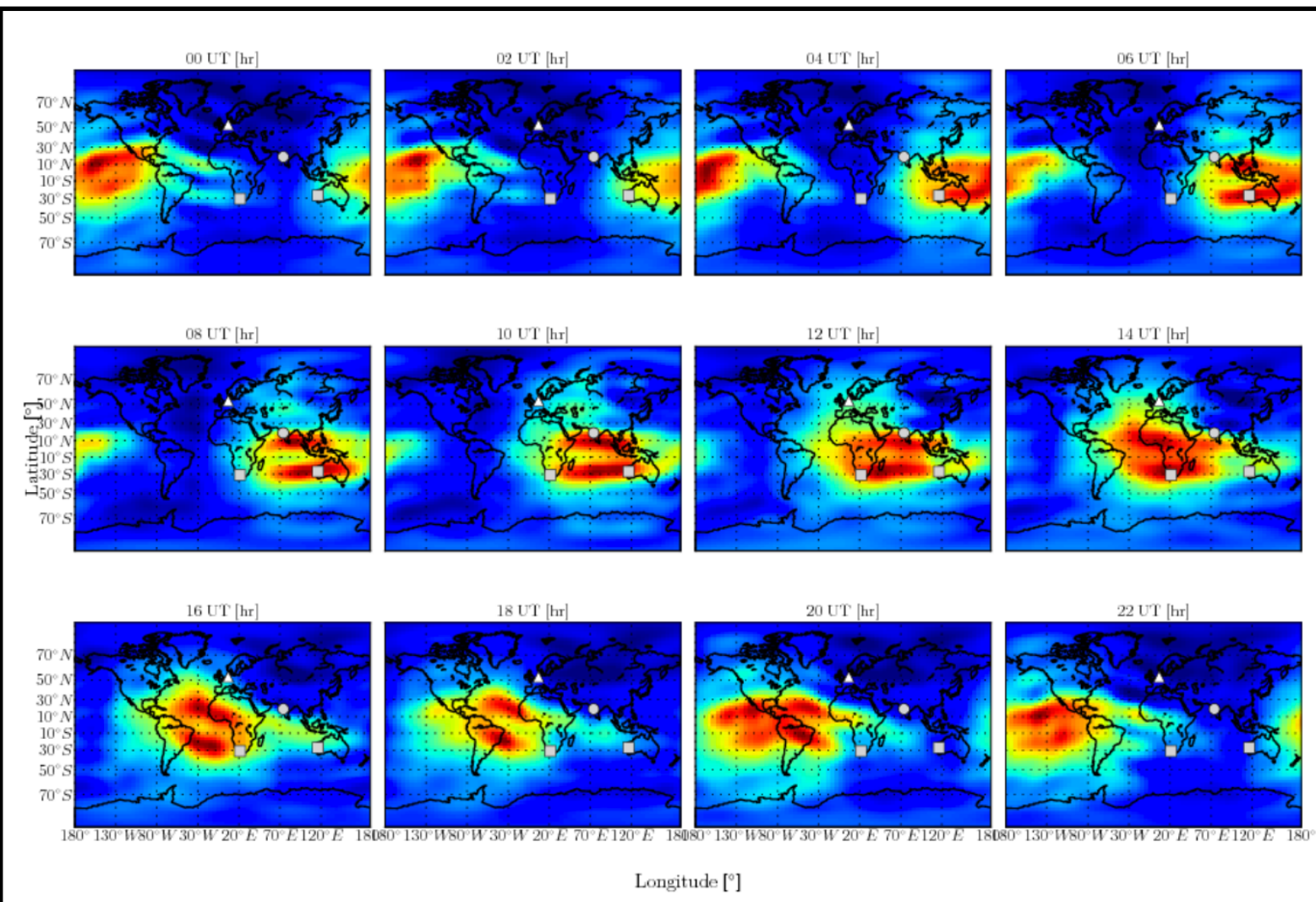
Vertical TEC maps

CODE

Time resolution 1-2 hr

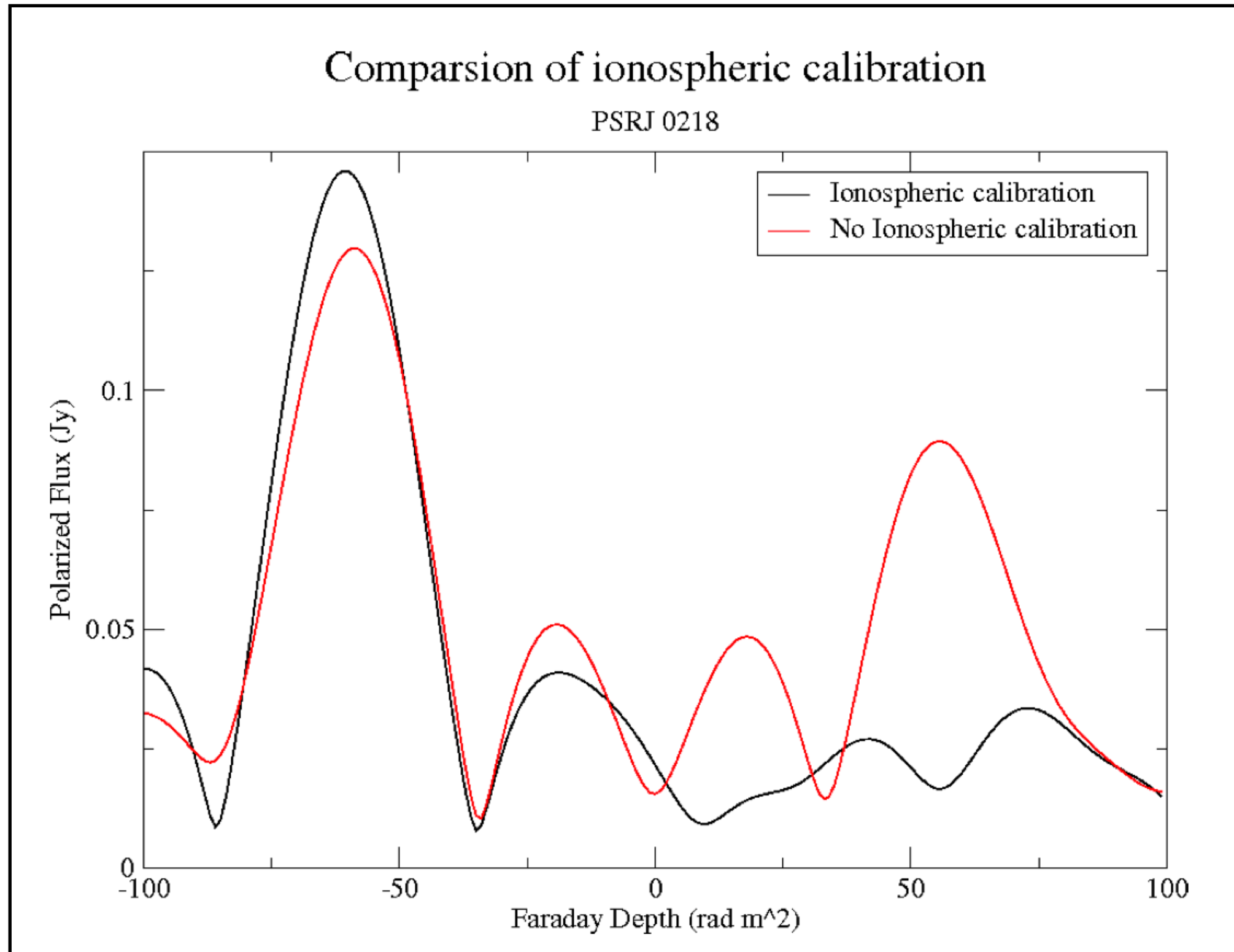
ROB

Time resolution 15 mins



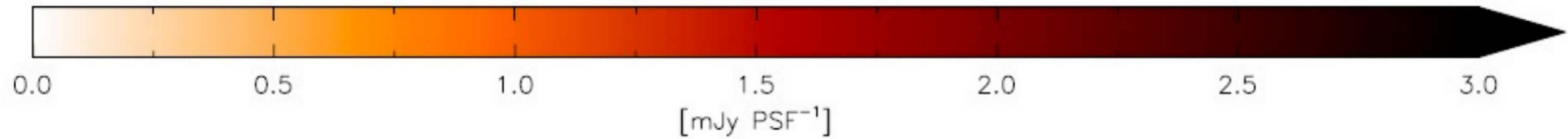
Effects of polarisation calibration

Shift of Faraday Depth

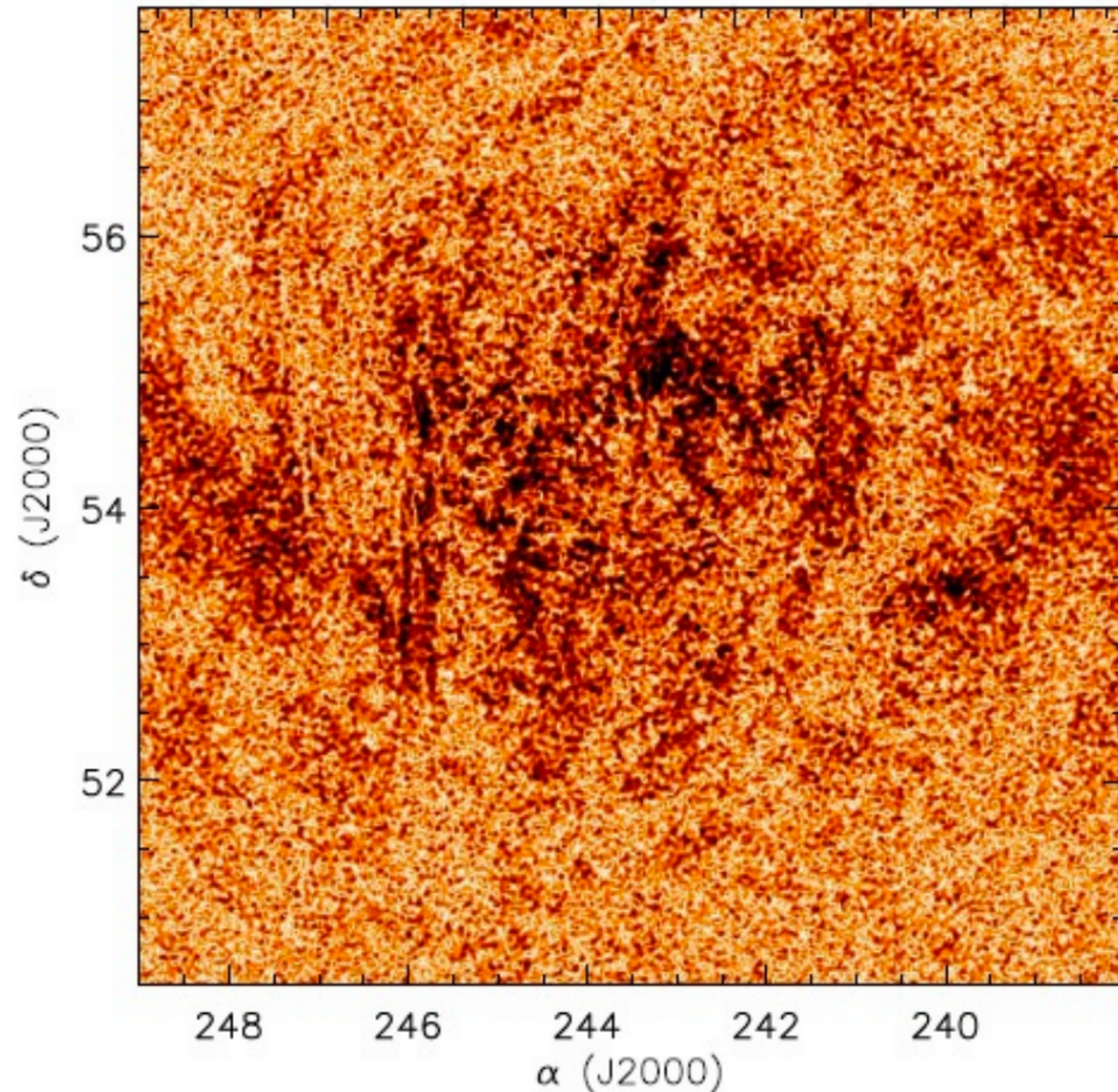


Effects of polarisation calibration

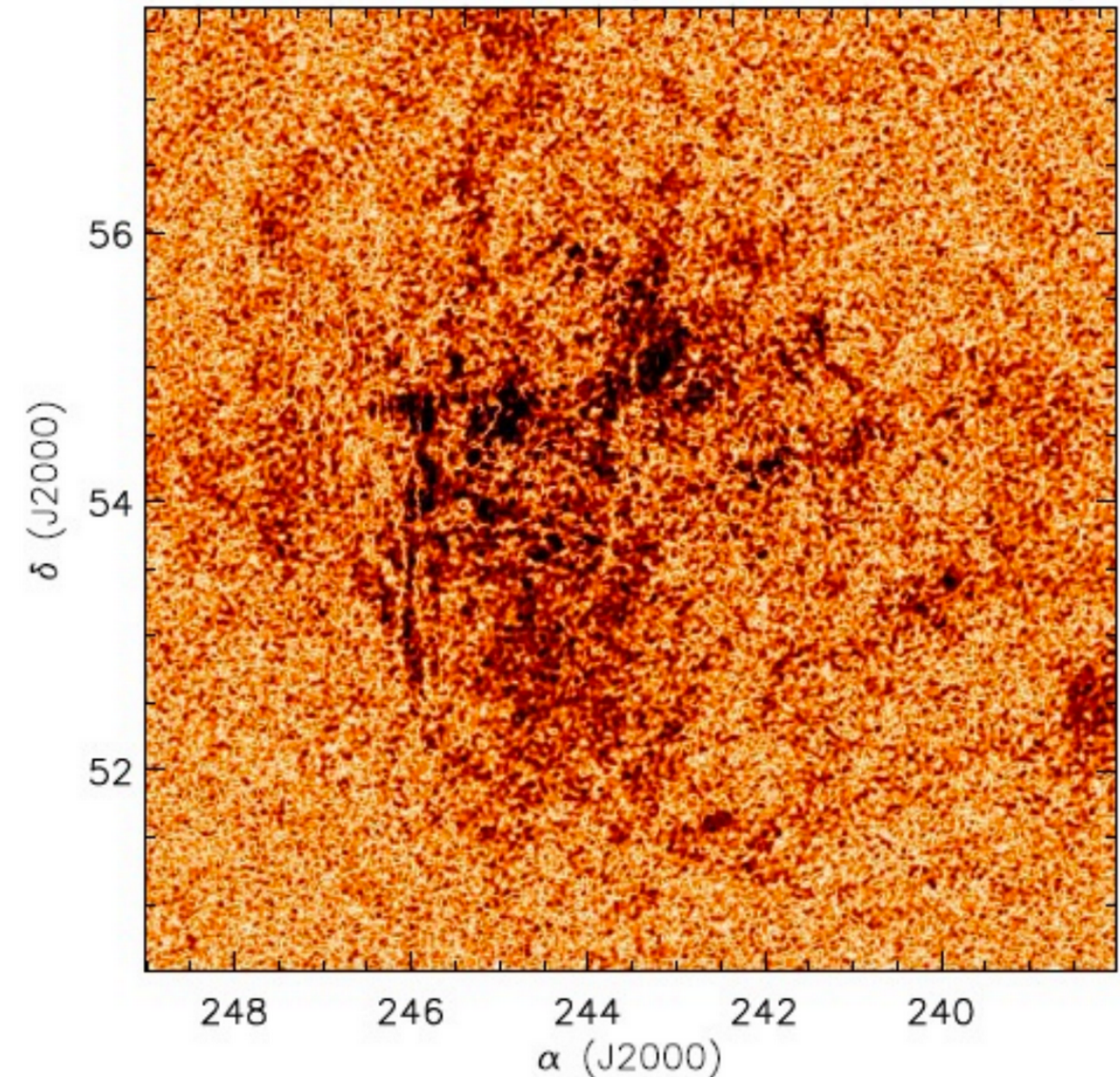
Decrease amount of depolarisation



before ion. RM corr. ($\Phi = +2.5 \text{ rad m}^{-2}$)



after ion. RM corr. ($\Phi = +1.5 \text{ rad m}^{-2}$)



Objective of Busy Week

Test new distributed version of RMextract — predicts the ionospheric RM over each LOFAR station.

maaijke / RMextract Watch 2 Star 0 Fork 0

extract TEC, vTEC, Earthmagnetic field and Rotation Measures from GPS and WMM data for radio interferometry observations

20 commits 1 branch 0 releases 1 contributor

branch: master RMextract / +

example_getRM_write_to_file debuggd by Tony

maaijke authored 14 days ago latest commit a44e2adb8f

EMM	removed more obsolete files	28 days ago
RMextract	removed bugs for Tony	14 days ago
examples	example_getRM_write_to_file debuggd by Tony	14 days ago
INSTALL	added INSTALL	27 days ago
README.md	moved readme	28 days ago
setup.py	first working version	27 days ago

README.md

Code

Issues 0

Pull requests 0

Pulse

Graphs

HTTPS clone URL

https://github.com

You can clone with [HTTPS](#) or [Subversion](#).

Clone in Desktop

Download ZIP

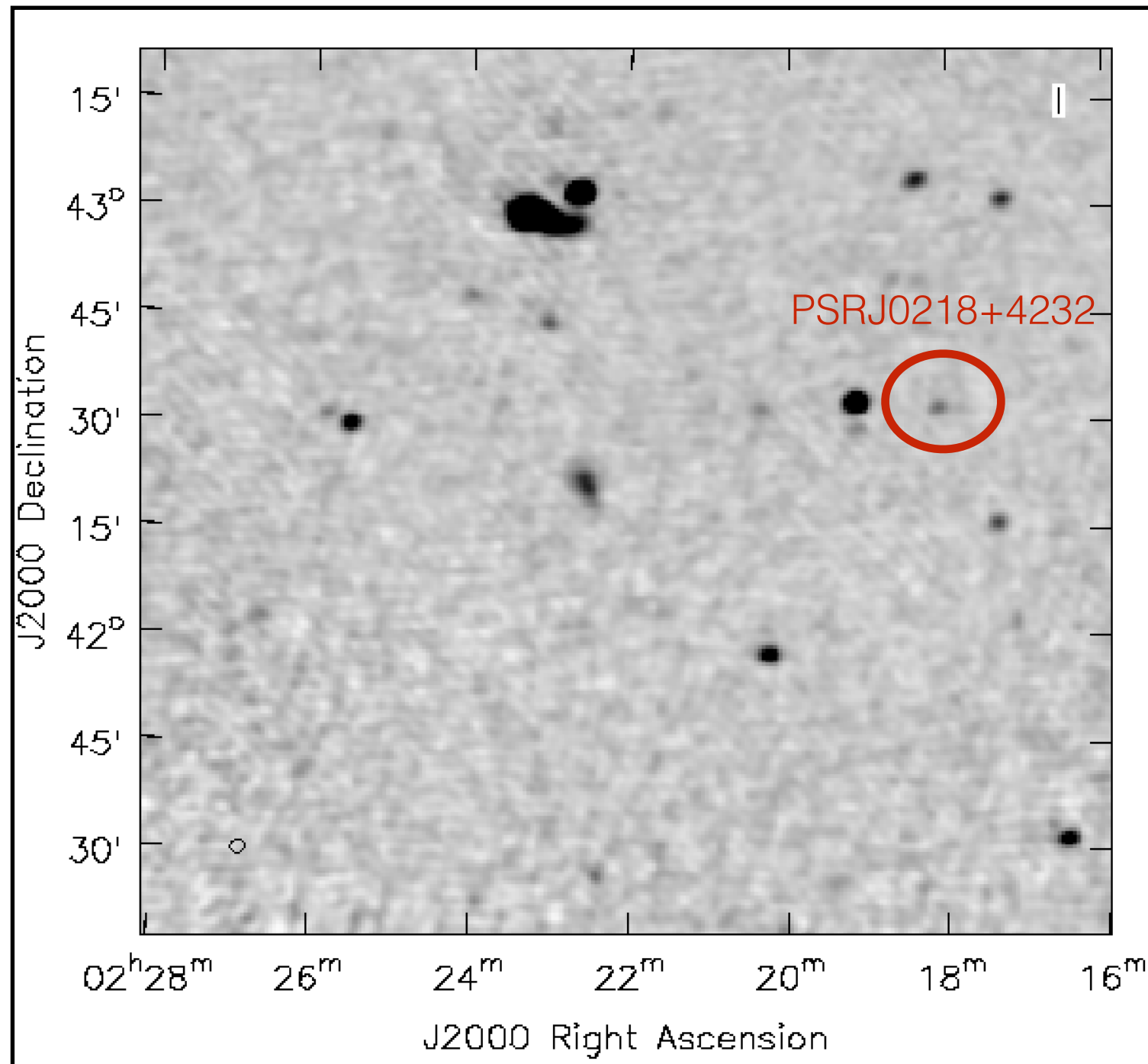
M.Mevius

Dataset

MSSS observation of field around PSRJ0218+4232

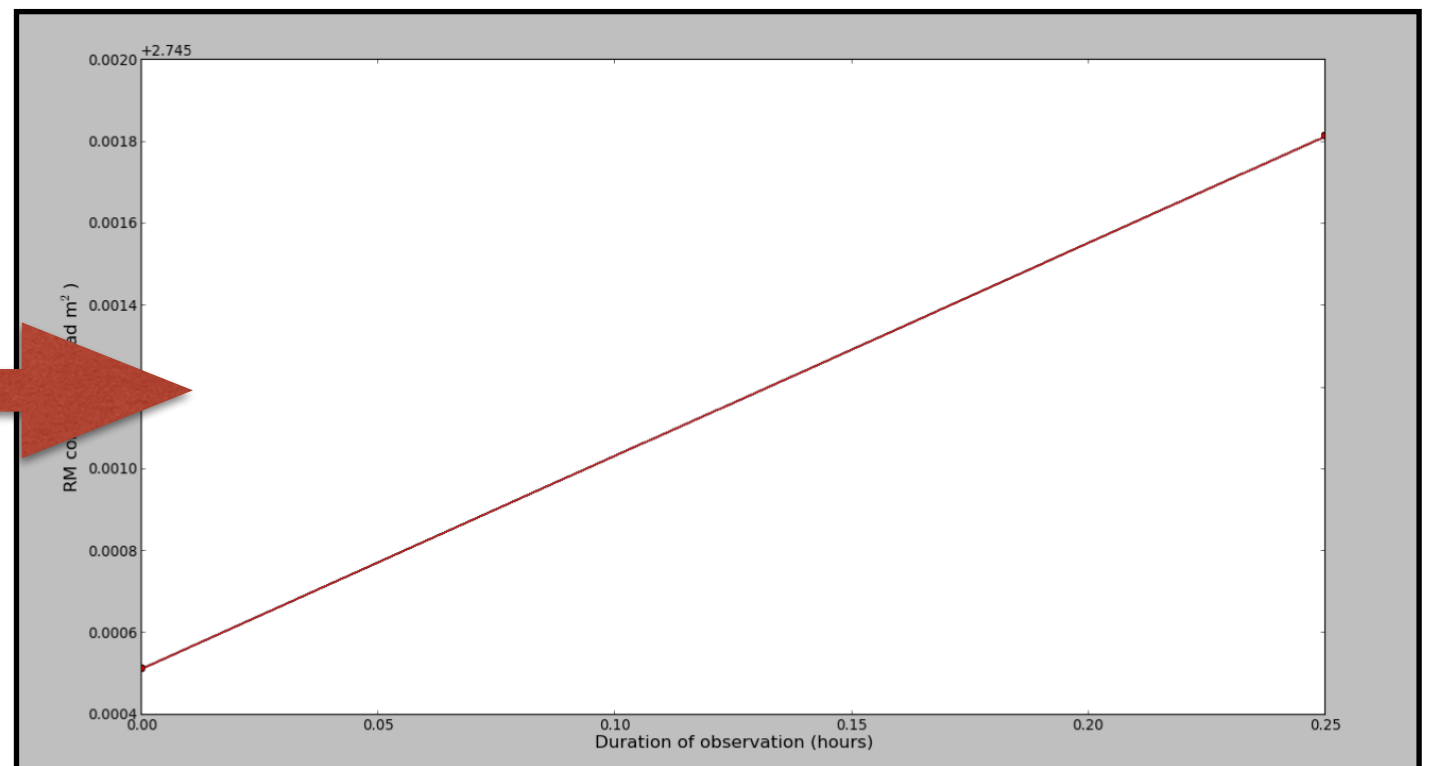
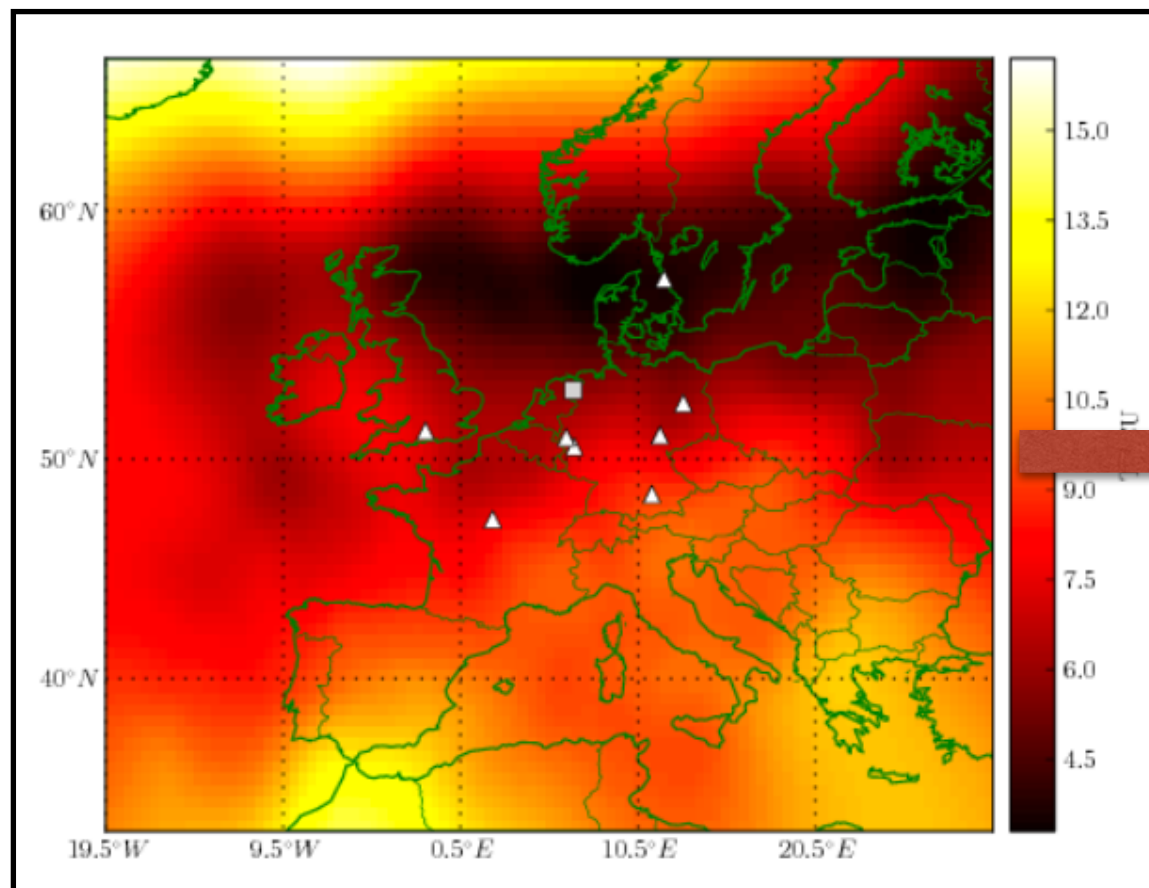
2 scans of 7 mins each

already processed — ready for polarisation calibration



Accomplishments

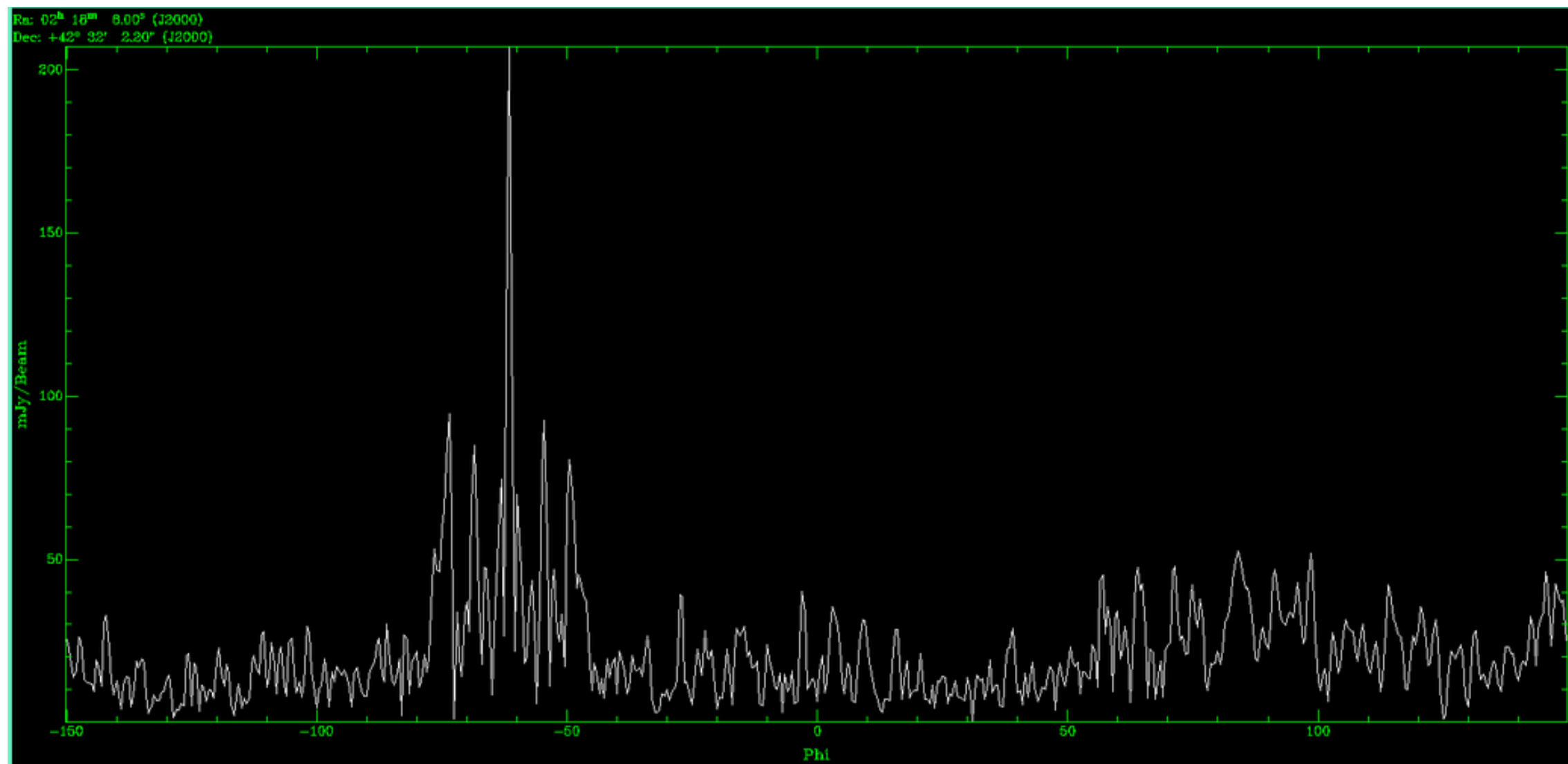
- ROB TEC maps can now be downloaded and read into RMExtract.



Accomplishments

- ROB TEC maps can now be downloaded and read into RMWriter.
- Both CODE and ROB TEC maps produce effectively identical results for our test data set: 2.73-2.77 rad/m² for CODE, 2.74-2.75 for ROB. (across the 7 minutes of the data set)
- After applying the correction (either ROB or CODE), the resulting RM cubes show the correct known RM for the pulsar, within the accuracy of the known RM value and our Faraday depth sampling.
- Measured polarized flux is effectively unchanged before and after ionospheric correction, for either TEC source.

Pre correction $\longrightarrow -59 \text{ rad/m}^{-2}$
Using Code TEC values $\longrightarrow -61.5 \text{ rad/m}^{-2}$
Using ROB TEC values $\longrightarrow -61.5 \text{ rad/m}^{-2}$

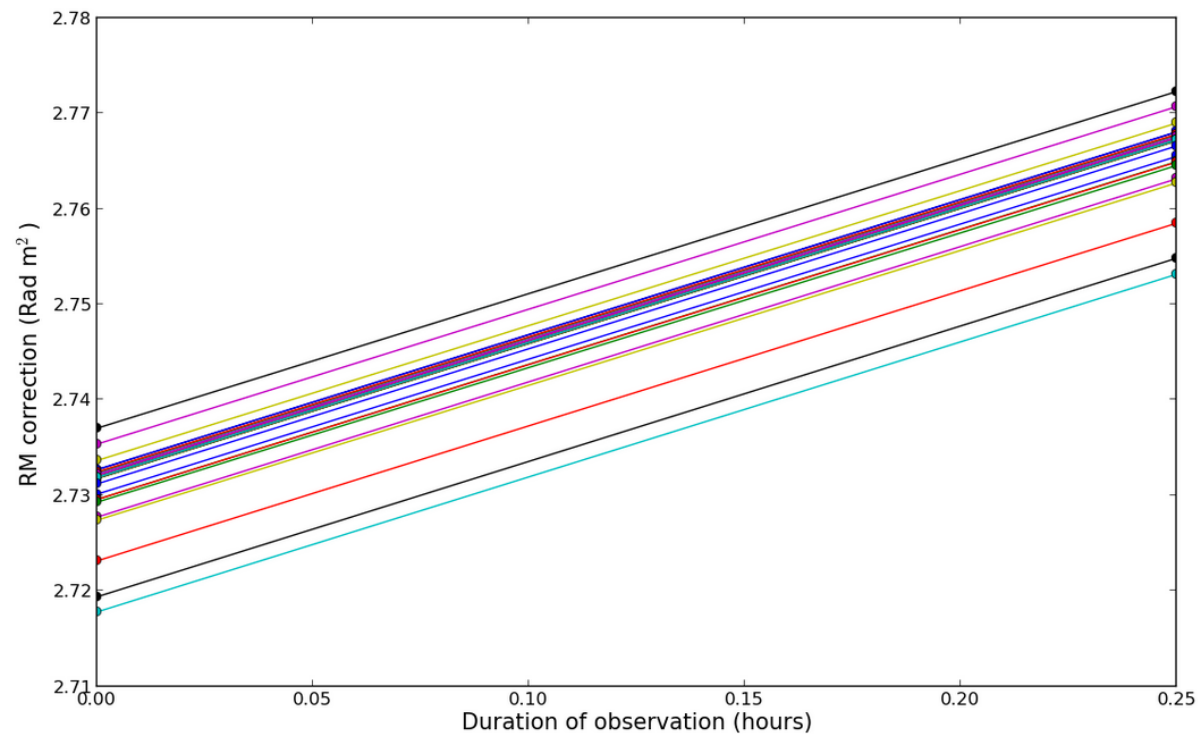


Accomplishments

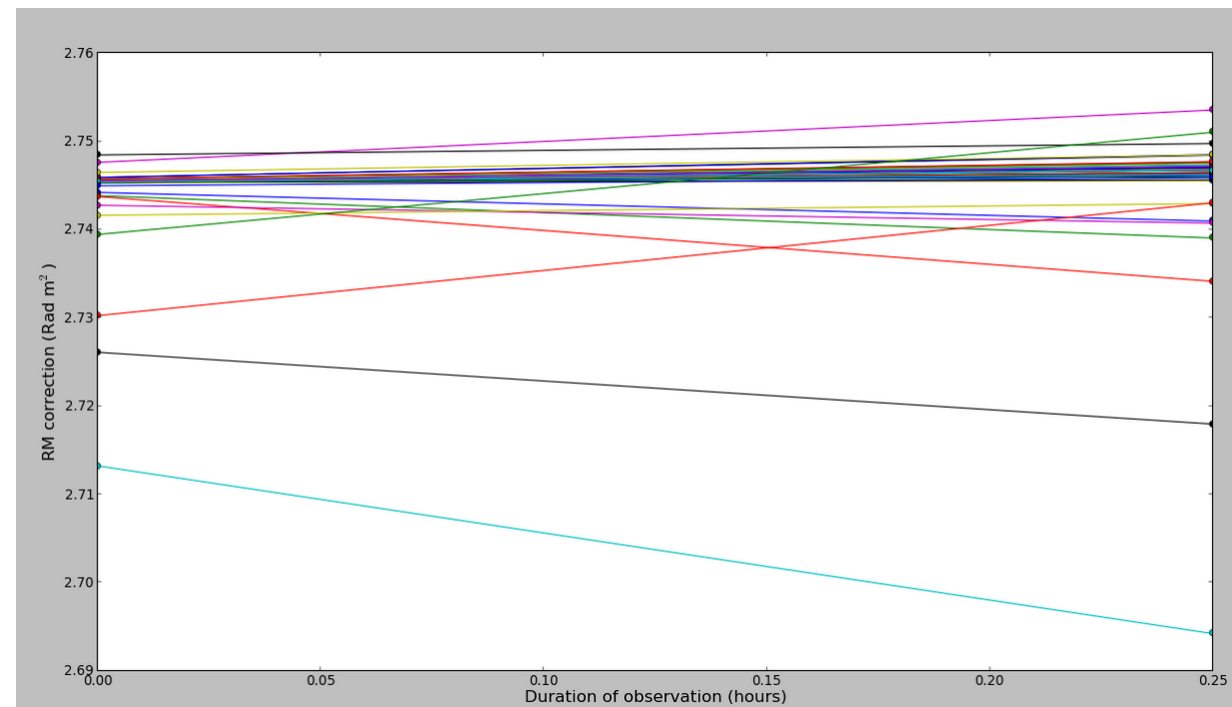
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- Measured polarized flux is effectively unchanged before and after ionospheric correction, for either TEC source.
- All of the command line options for createRMparmdb should now be working properly.

Finding RM correction per station found to be working

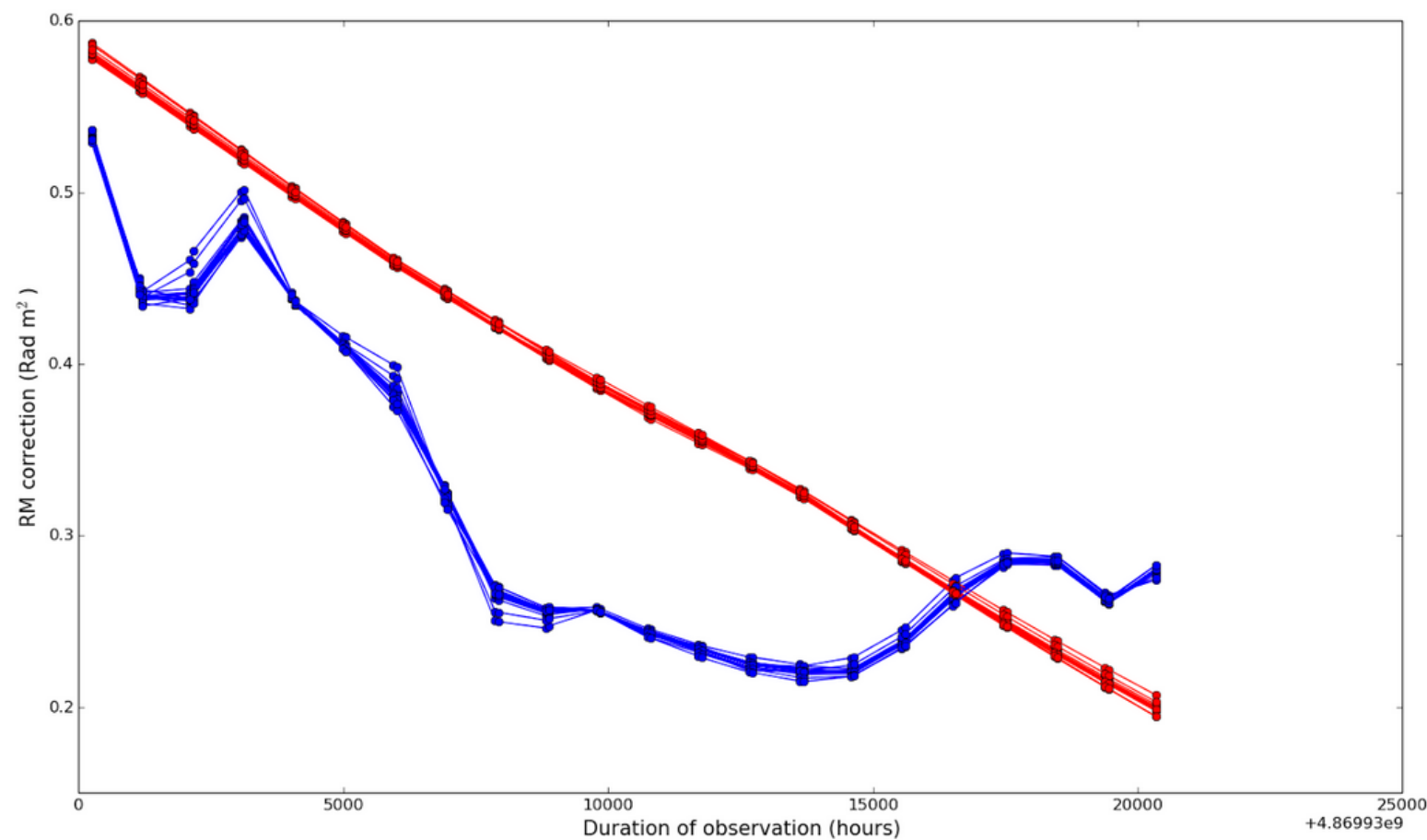
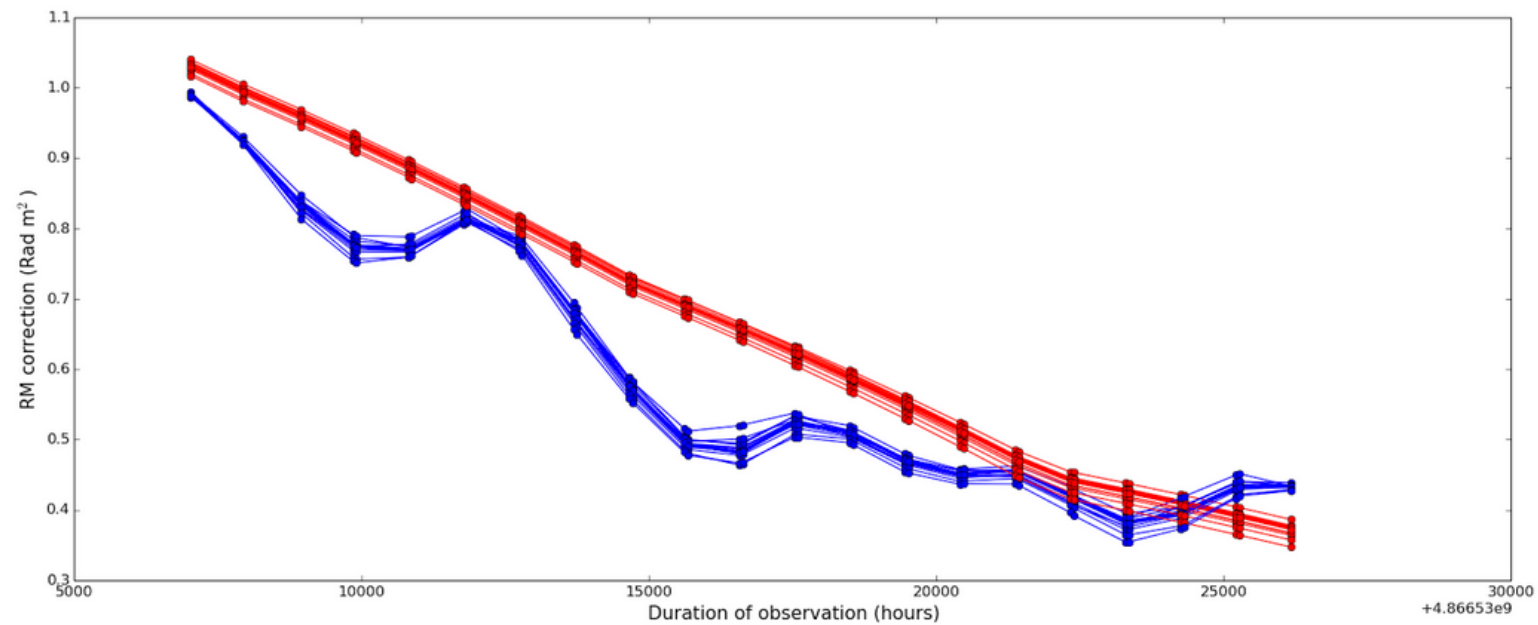
CODE



ROB



Comparison between CODE and ROB for a longer observation



Further work

Need longer observation of pulsar with accurately known FD.
Commissioning proposal is being worked on.

Future work will focus on calibrate on-axis leakage, calibrating
cross correlation phases
These will continue at the next busy week in August.

In the meantime, a polarisation analysis meeting will take
place in June at ASTRON
Anyone who is interested in helping out at these busy weeks
send me a mail.

Many thanks to Maaijke and to all participants!